

Some Digenea from Freshwater Fishes of Alabama and Florida including *Allocreadium* (*Neallocreadium*) *lucyae* sp. n. (Digenea: Allocreadiidae)

ERNEST H. WILLIAMS, JR.¹ AND WILLIAM G. DYER²

¹ Caribbean Aquatic Animal Health Project, Department of Marine Sciences, University of Puerto Rico, P.O. Box 908, Lajas, Puerto Rico 00667-0908 and

² Department of Zoology, Southern Illinois University, Carbondale, Illinois 62901-6501

ABSTRACT: *Allocreadium* (*Neallocreadium*) *lucyae* sp. n. is described from the bandfin shiner, *Notropis zonistius*, of east central Alabama. It differs from its most similar species, *Allocreadium* (*Neallocreadium*) *elongatum*, in having contiguous testes, cecal bifurcation at the level of the acetabulum, and vitellaria commencing at the acetabular level. Comparison is made to all species of *Allocreadium* from New World fishes. Twenty-eight new host records for *Azygia longa*, *Bucephaloides pusillus*, *Crepidostomum cooperi*, *Pisciamphistoma stunkardi*, and *Posthodiplostomum minimum* in freshwater fishes are noted. Slight variations from the description in our specimens of *Alloglossidium corti* are discussed.

KEY WORDS: Digenea, *Allocreadium* (*Neallocreadium*) *lucyae*, *Crepidostomum cooperi*, *Alloglossidium corti*, freshwater fishes, new host record, new locality records, Alabama, Florida, *Azygia longa*, *Bucephaloides pusillus*, *Pisciamphistoma stunkardi*, *Posthodiplostomum minimum*.

The present report is concerned with the description of a new species of *Allocreadium* from the bandfin shiner of Alabama which represents the fourth species of this large genus recorded from New World fishes. In addition, 28 new host records and numerous new locality records in Alabama and Florida are given.

Materials and Methods

Fishes were collected with monofilament gill nets, backpack shocker, and 4.6-m seine. Live specimens of digeneans were removed from the hosts within a few hours of capture. Metacercariae were removed from cysts. Worms were fixed in hot 10% formalin; whole mounts were stained in Semichon's carmine. Some worms were embedded in paraffin, sectioned at 10 μ m, and stained with Harris' hematoxylin and eosin. All specimens are deposited in the U.S. Helminthological Collection (USNM). Measurements are in micrometers unless otherwise indicated. Drawings were made with the aid of a microprojector.

Allocreadiidae Stossich, 1903

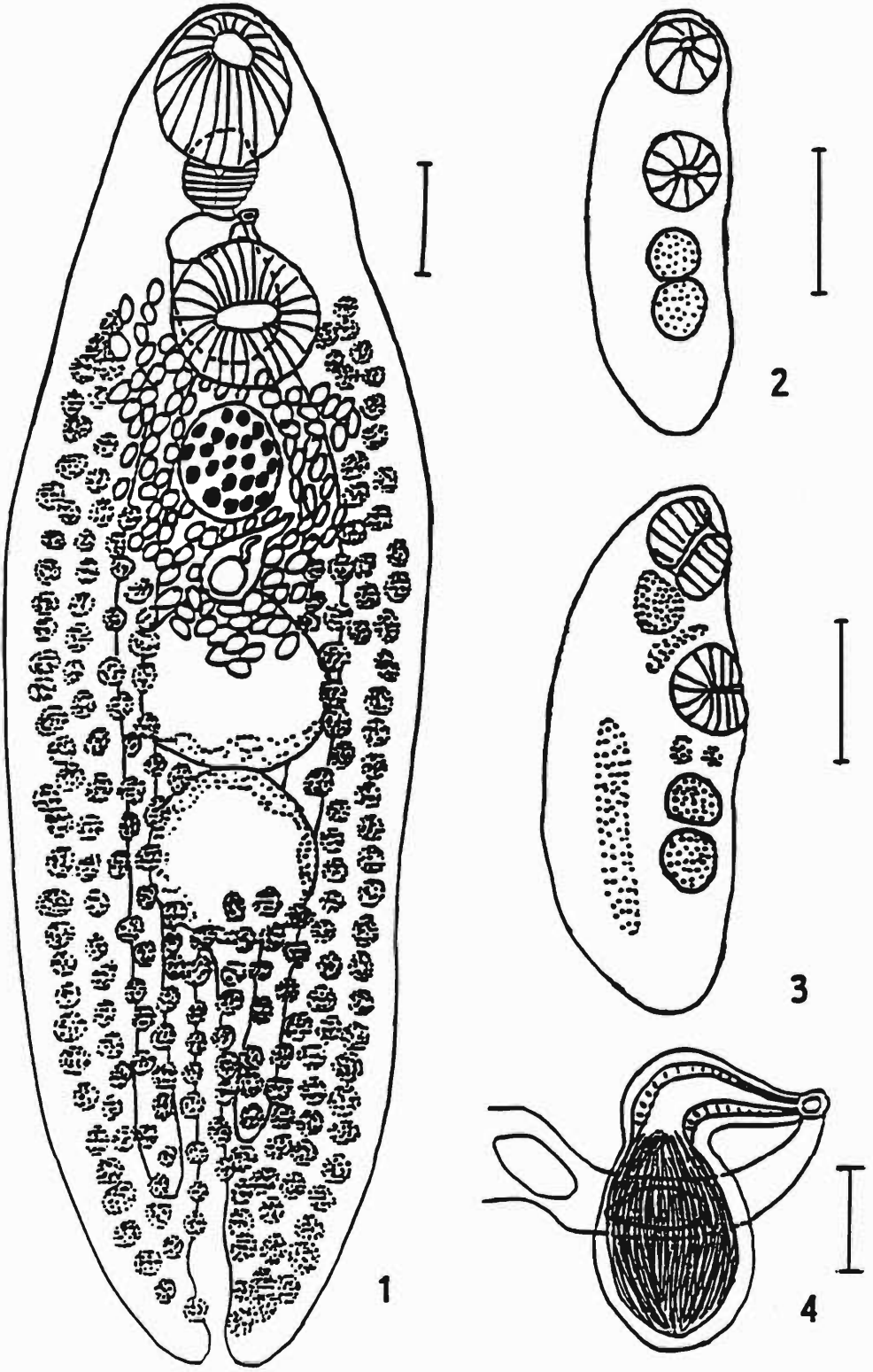
Allocreadiinae Looss, 1902

Allocreadium (*Neallocreadium*) *lucyae* sp. n. (Figs. 1–4)

DESCRIPTION: Measurements based on 2 whole mounts and 1 sectioned specimen ($N = 3$ unless noted). With characters of genus and subgenus. Body oval, flattened, tapering at both ends, 2.05–2.58 (2.36) mm long, 692–823 (775) wide. Oral sucker subterminal, 239–289 (264) long, 249–324 (282) wide. Acetabulum in anterior one-third of body, slightly larger than oral sucker, 264–349 (297) long, 289–374 (325) wide. Oral

sucker connects directly with pharynx without prepharynx. Pharynx well developed, 134–167 (148) long, 129–154 (141) wide. Esophagus long, 181 ($N = 1$). Cecal bifurcation dorsal of acetabulum; ceca terminate blindly near posterior end of body, subequal. Testes contiguous, subequal in size, in middle one-third of body, oval, smooth, tandem, median; anterior testis 264–274 (269) long, 249–344 (294) wide; posterior testis 304–349 (324) long, 314–324 (321) wide. Post-testicular space 561–790 (683). Seminal receptacle pear-shaped between ovary and anterior testis, in dorsoventral plane of ceca, 154–174 (168) long, 97–105 (102) wide. Cirrus pouch well developed, positioned ventral of cecal bifurcation and dorsal of acetabulum, curling ventrally anterior of acetabulum, 244–309 (276) long, 139–174 (152) wide. Genital pore median, preacetabular. Ovary smooth, subspherical, just posterior to acetabulum, largely in dorsoventral plane of ceca, 194–224 (210) long, 204–214 (209) wide. Uterus extends from anterior of testis to acetabulum. Eggs oval, measured in utero ($N = 20$), 71–79 long, 47–51 wide. Vitellaria commencing at acetabulum and extending uninterrupted to posterior end of body, median and lateral posteriorly, lateral anteriorly with few follicles extending into median field. Excretory pore terminal, excretory vesicle I-shaped, extending from terminal end of body to posterior of posterior testis.

TYPE SPECIMENS: Holotype (USNM 81414), 2 paratypes (1 sectioned) (USNM 81415), 3 immatures (USNM 81416).



TYPE HOST: Bandfin shiner, *Notropis zonistius* (Jordan) (Cypriniformes: Cyprinidae).

TYPE LOCALITY: Mill Creek north of Valley, Alabama (18 February 1971); Lat. 32°51'N, Long. 85°12'W.

ADDITIONAL HOST AND LOCALITY: Rough shiner, *Notropis baileyi* Suttkus and Raney, Choclafla Creek, northeast of Tuskegee, Macon County, Alabama (4 April 1972).

OCCURRENCE: Intestine of host. Adults and immature worms 1 to 2 per host. Of 29 type hosts at the type locality, 6 were infected with adult worms. Seven specimens of the type host collected from the same creek on the same day east of Valley were negative for this worm. Thirty-two specimens of the type host collected from the type locality 10 March 1972 were also negative.

REMARKS: The authors agree with Yamaguti (1971) in recognizing 3 subgenera of the genus *Allocreadium*, namely, *Allocreadium* Looss, 1900, *Allocreadioides* Koval, 1949, and *Neoallocreadium* Akhmerov, 1960, based on the location of the cirrus pouch and uterus and the distribution of the vitellaria. Our specimens conform to the diagnosis for *Neoallocreadium* in that the uterus extends ventral to the anterior testis, the vitellaria extend well into the forebody, and the large cirrus pouch may reach to the posterior end of the acetabulum. The new species is designated *Allocreadium* (*Neoallocreadium*) *lucyae* and most closely resembles *A. (N.) elongatum* Akhmerov, 1960 (syn. *Neoallocreadium pseudaspis* Akhmerov, 1960), described from *Erythrocultus mongolicus* of the Amur River, but differs in having contiguous rather than noncontiguous testes, cecal bifurcation at the level of the acetabulum rather than at the level of the anterior margin of the ovary, and vitellaria commencing at the acetabular level rather than anterior to the acetabulum or almost at the level of the pharynx.

Three species of *Allocreadium* are recognized from New World fishes, namely, *Allocreadium* (*Allocreadium*) *lobatum* Wallin, 1909 (North America), *Allocreadium* (*Neoallocreadium*) *mexicanum* Osorio-Sarabia, Pérez-Ponce de León, and Salgado-Maldonado, 1986 (Michoa-

cán, Mexico), and *Allocreadium* (*Neoallocreadium*) *centropomi* Fischthal and Nasir, 1974 (Venezuela) (Yamaguti, 1971). Of New World species, *A. (N.) lucyae* most closely resembles *A. (A.) lobatum*, but differs in having spherical to oval instead of lobate testes, vitellaria commencing at the level of the acetabulum instead of the ovary, and an excretory bladder that does not reach the posterior testis. The new species differs from *A. (N.) centropomi* by having a long rather than a short esophagus, smooth rather than lobate testes, an excretory bladder that does not reach the posterior testis, and vitellaria commencing at the acetabulum rather than posterior to the acetabulum. It differs from *A. (N.) mexicanum* in that the testes are located in the middle third of the body rather than the posterior third, ceca terminating near the posterior end of the body rather than at the anterior edge of the posterior testis, and an acetabulum slightly longer than the oral sucker and located in the anterior third of the body rather than twice as long and located in the middle third.

This digenean was not found in more than 2,500 specimens of 141 species of freshwater fishes examined in the southeastern U.S.A. (Amin and Williams, 1983). It did not occur in 175 specimens of 13 other species of *Notropis* examined from 24 other collecting sites.

ETYMOLOGY: This specimen is named for Dr. Lucy Bunkley-Williams.

Crepidostomum cooperi Hopkins

NEW HOST AND LOCALITY (date): Spotted sunfish, *Lepomis punctatus* (Valenciennes) (Perciformes: Centrarchidae), unnamed tributary of Chattahoochee River near Huguley, Alabama, at Interstate 85 intersection (24 February 1972) (USNM 81368).

HOSTS AND NEW LOCALITIES (dates): Redbreast sunfish, *Lepomis auritus* (Linnaeus), same location and date as above (USNM 81367); longear sunfish, *Lepomis megalotis* (Rafinesque), Calebee Creek, south of Tuskegee, Alabama (11 February 1969) (USNM 81369).

REMARKS: Cooper (1915) briefly described specimens of *Crepidostomum* from *Perca flavesc-*

Figures 1–4. *Allocreadium* (*Neoallocreadium*) *lucyae* sp. n. 1. Ventral view largely of the holotype, some details from sectioned paratype. Scale = 0.2 mm. 2, 3. Immature specimens showing oral sucker, acetabulum, and testes with developing stages of ovary, pharynx, and ceca. Scale = 0.2 mm. 4. Terminal genitalia of paratype. Scale = 0.1 mm.

Table 1. Digenea from some Alabama and Florida freshwater fishes.

Digenea Host	N/H*	Site	I/E†	Sizes (cm)	Locality	Date	USNM no.
<i>Alloglossidium corti</i> (Lamont, 1921)							
<i>Lepomis gulosus</i>	1	int.	1/1	14.0	Euphapy Creek, SW of Auburn, Alabama	8 Jul 1970	
<i>Apophallus venustus</i> (Ransom, 1920)							
<i>Lepisosteus osseus</i>	13	mouth†	1/1	91.4	Devil's Channel, Mobile Bay, Alabama	9 Apr 1970	
<i>Azygia longa</i> (Leidy, 1851)							
<i>Esox americanus</i> §	1-2	stom.	2/3	20.3	Euphapy Creek, SW of Auburn, Alabama	8 Jul 1970	81492
<i>Bucephaloides pusillus</i> (Stafford, 1937)							
<i>Esox americanus</i> §	50	int.	1/1	32.9	Euphapy Creek, SW of Auburn, Alabama	28 Mar 1970	81494
<i>Crepidosomum cooperi</i> Hopkins, 1931							
<i>Esox niger</i>	1	int.	1/1	9.3	Chattahoochee River, Huguley, Alabama	15 Nov 1982	
<i>Homalometron armatum</i> (MacCallum, 1895)							
<i>Aplodinotus grunniens</i>	2	int.	1/2	41.0	Cahaba River, NW of Selma, Alabama	12 Jan 1973	
<i>Neochasmus icaluri</i> Sogandares-Bernal, 1953							
<i>Ictalurus furcatus</i>	3	int.	1/2	30.5	Tombigbee River, S of Demopolis, Alabama	20 Apr 1970	
<i>Pisciamphistoma stunkardi</i> (Holl, 1929)							
<i>Esox americanus</i> §	7	int.	2/3	20.3	Euphapy Creek, SW of Auburn, Alabama	8 Jul 1970	81493
<i>Plagiocirrus primus</i> Van Cleave and Mueller, 1932							
<i>Notemigonus crysoleucas</i>	4-12	int.	5/5	13.0-25.0	Santa Fe River, N of Gainesville, Florida	12 Dec 1972	
<i>Polyekithum icaluri</i> (Pearse, 1924)							
<i>Ictalurus furcatus</i>	3	int.	1/2	30.5	Tombigbee River, S of Demopolis, Alabama	20 Apr 1970	

Posthodiplostomum minimum (MacCallum, 1921)

<i>Carpiodes velifer</i>	1	mes.	1/1	27.9	Euphapy Creek, SW of Auburn, Alabama	27 May 1971	81495
<i>Centrarchus macropterus</i> §	1	mes.	1/1	7.6	Euphapy Creek, SW of Auburn, Alabama	1 Apr 1970	81496
<i>Cottus pygmaeus</i> §	2	mes.	1/5	2.9-3.2	Cold Spring, W of Oxford, Alabama	24 Sep 1971	81497
<i>Elassoma zonatum</i> §	2	mes.	1/5	2.5	Euphapy Creek, SW of Auburn, Alabama	28 Mar 1970	81498
<i>Erimyzon oblongus</i> §	2	mes.	1/45	22.9	Beaver Swamp Creek, S of Lanett, Alabama	6 Feb 1971	81499
<i>Erimyzon tenuis</i> §	1	mes.	1/11	34.1	Fish River, SE of Fairhope, Alabama	24 Feb 1973	81500
<i>Esox americanus</i> §	2	mes.	1/3	12.7	Euphapy Creek, SW of Auburn, Alabama	26 Mar 1970	81501
<i>Hypentelium etowanum</i> §	13	mes.	1/2	22.9	Loblockee Creek, Auburn, Alabama	14 Jan 1971	81502
<i>Ictalurus furcatus</i> §	2	mes.	1/2	30.5	Tombigbee River, S of Demopolis, Alabama	20 Apr 1970	81503
<i>Ictalurus serracanthus</i> §	1	mes.	1/1	26.7	Santa Fe River, N of High Springs, Florida	14 Feb 1972	81504
<i>Micropterus coosae</i> §	10	mes.	1/2	20.5	Loblockee Creek, Auburn, Alabama	14 Jan 1971	81505
<i>Minytrema melanops</i> §	4	mes.	1/1	15.2	Euphapy Creek, SW of Auburn, Alabama	1 Apr 1970	81506
<i>Moxostoma carinatum</i> §	1	mes.	1/3	53.8	Sandy Creek, N of Bosworth, Alabama	24 Apr 1973	81507
<i>Nocomis leptoccephalus</i> §	2	mes.	1/2	12.8	Mill Creek, N of Valley, Alabama	18 Feb 1971	81508
<i>Notropis bailey</i> §	1-34	mes.	4/4	5.1	Euphapy Creek, SW of Auburn, Alabama	16 Mar 1970	81509
<i>Notropis bellus</i> §	1	mes.	1/1	7.6	Euphapy Creek, SW of Auburn, Alabama	16 Mar 1970	81510
<i>Notropis caeruleus</i> §	2	mes.	1/1	6.0	Cahaba River, NW of Selma, Alabama	12 Jan 1973	81511
<i>Notropis callisius</i> §	3	mes.	1/5	11.5	Salt Creek, SE of Munford, Alabama	22 Jan 1974	81512
<i>Notropis chrysoccephalus</i> §	3-7	mes.	2/2	5.0-13.0	Euphapy Creek, SW of Auburn, Alabama	16 Mar 1970	81513
<i>Notropis texanus</i> §	2	mes.	1/2	7.8	Lake Martin, W of Dadeville, Alabama	13 Aug 1973	81514
<i>Notropis venustus</i> §	6	skin	1/1	7.6	Euphapy Creek, SW of Auburn, Alabama	16 Mar 1970	81515
<i>Notropis zonistius</i> §	5	mes.	1/7	15.5	Mill Creek, E of Valley, Alabama	18 Feb 1971	81516
<i>Noturus leptacanthus</i> §	1	mes.	1/1	4.5	Santa Fe River, N of Gainesville, Florida	14 Feb 1972	81517
<i>Percina carpiodes</i> §	3	mes.	1/1	10.2	Euphapy Creek, SW of Auburn, Alabama	16 Mar 1970	81518

* Number of worms per host.
† Number of hosts infected/number of hosts examined.
‡ Immature in cysts in mouth and tongue.
§ New host record.

cens, *Lepomis gibbosus*, *Etheostoma nigrum*, and *E. exile* taken at Go-Home Bay, Ontario, under the name *Crepidostomum laureatum* (Zeder). Hopkins (1931) re-examined Cooper's specimens and ascertained that the specimens from *Perca flavescens* and those from *Etheostoma nigrum* represented 2 distinct new species that were designated as *Crepidostomum cooperi* for the former and *Crepidostomum canadense* for the latter. In her revision of North American species of papillose allocreadiids, Caira (1989) pointed out that although Hopkins (1931, 1934) listed several criteria with which to distinguish *Crepidostomum cooperi* from *Crepidostomum cornutum* (Osborn, 1903) Stafford, 1904, the criteria are not always consistent and variation in these characters overlaps between the 2 species. Likewise, the characters utilized by Amin (1982) in his key to the North American species of *Crepidostomum* do not adequately distinguish between these 2 species. Our specimens concur with the description of *C. cooperi* as given by Caira (1989) who was able to distinguish adults of these 2 species based on differences in the size of the seminal vesicle and subsequently the position of the pars prostatica within the cirrus sac.

Alloglossidium corti (Lamont)

HOSTS AND NEW LOCALITY (date): Yellow bullhead, *Ictalurus natalis* (Lesueur) (Siluriformes: Ictaluridae), Euphapy Creek at Interstate 85 intersection, southwest of Auburn, Alabama (26 March 1970) (USNM 81408); unnamed tributary of Chattahoochee River near Huguley, Alabama, at Interstate 85 intersection (24 February 1972) (USNM 81409); brown bullhead, *Ictalurus nebulosus* (Lesueur), Euphapy Creek at Interstate 85 intersection, southwest of Auburn, Alabama (16 March 1970) (USNM 81407).

REMARKS: Our specimens varied slightly from the description of this species. Vitellaria usually began anteriorly just anterior of acetabulum, but occasionally at posterior margin of pharynx. Vitellaria usually end posteriorly between testes, but occasionally extend beyond posterior end of last testis. Some follicles extended into the median field. Acetabulum usually smaller than oral sucker, but occasionally equal or larger. This species has been reported from the channel catfish, *Ictalurus punctatus* (Rafinesque) (Ictaluridae), in

Alabama (Allison, 1957) and from this host, in general, from the southeastern U.S.A. (Plumb, 1985).

Collection records for 10 species of digeneans from freshwater fishes from Alabama and Florida are given in Table 1. New host and locality records are noted. Records, which do not represent new hosts, are included because few records of Digenea in freshwater fishes from Alabama have been reported.

Acknowledgments

We thank Ronald P. Phelps and Joseph R. Sullivan for help in collecting hosts. Support was provided by the Southeastern Cooperative Fish Disease Project (in part by Sport Fish Restoration funds) and the Department of Natural Resources of the Commonwealth of Puerto Rico and Wallop Breaux funds.

Literature Cited

- Allison, R. 1957. A preliminary note on the use of di-n-butyl tin oxide to remove tapeworms from fish. *The Progressive Fish-Culturist* 19:128-130.
- Amin, O. M. 1982. Adult trematodes (Digenea) from lake fishes of southeastern Wisconsin, with a key to species of the genus *Crepidostomum* Braun, 1900 in North America. *Proceedings of the Helminthological Society of Washington* 49:196-206.
- , and E. H. Williams, Jr. 1983. *Acanthocephalus alabamensis* sp. n. (Acanthocephala: Echinorhynchidae) from Alabama fishes. *Journal of Parasitology* 69:764-768.
- Caira, J. N. 1989. A revision of the North American papillose Allocreadiidae (Digenea) with independent cladistic analysis of larval and adult forms. *Bulletin of the University of Nebraska State Museum* 11:1-58.
- Cooper, A. R. 1915. Trematodes from marine and freshwater fishes, including one species of ectoparasitic turbellarian. *Transactions of the Royal Society of Canada* 9:181-205.
- Hopkins, S. H. 1931. Studies on *Crepidostomum* II. The "*Crepidostomum laureatum*" of A. R. Cooper. *Journal of Parasitology* 18:79-91.
- . 1934. The papillose Allocreadiidae. A study of their morphology, life histories, and relationships. *Illinois Biological Monographs* 13:4-80.
- Plumb, J. A., ed. 1985. Principal diseases of farmed catfish. *Southern Cooperative Series Bulletin* No. 225. 76 pp.
- Yamaguti, S. 1971. *Synopsis of Digenetic Trematodes of Vertebrates*. Keigaku Publishing Co., Tokyo, Japan. 1,074 pp.